National Institute of Environmental Health Sciences

A synoptic climatological approach to assess climatic impact on air quality in south-central Canada. Part II: Future estimates

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Abstract:

Using within-weather-group air pollution prediction models developed in Part I of this research, this study estimates future air pollution levels for a variety of pollutants (specifically, carbon monoxide – CO, nitrogen dioxide – NO2, ozone – O3, sulphur dioxide – SO2, and suspended particles – SP) under future climate scenarios for four cities in south-central Canada. A statistical downscaling method was used to downscale five general circulation model (GCM) scenarios to selected weather stations. Downscaled GCM scenarios were used to compare respective characteristics of the weather groups developed in Part I; discriminant function analysis was used to allocate future days from two windows of time (2040–2059 and 2070–2089) into one of four weather groups. In Part I, the four weather groups were characterised as hot, cold, air pollution-related, and other (defined as relatively good air quality and comfortable weather conditions). In estimating future daily air pollution concentrations, three future pollutant emission scenarios were considered: Scenario I – emissions decreasing 20% by 2050, Scenario II – future emissions remaining at the same level as at the end of the twentieth century, and Scenario III – emissions increasing 20% by 2050. The results showed that, due to increased temperatures, the average annual number of days with high O3 levels in the four selected cities could increase by more than 40–100% by the 2050s and 70–200% by the 2080s (from the current areal average of 8 days) under the three pollutant emission scenarios. The corresponding number of low O3 days could decrease by 4–10% and 5–15% (from the current areal average of 312 days). For the rest of the pollutants, future air pollution levels will depend on future pollutant emission levels. Under emission Scenarios II and III, the average annual number of high pollution days could increase 20–40% and 80–180%, respectively, by the middle and late part of this century. In contrast, under Scenario I, the average annual number of high pollution days could decrease by 10–65%.

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Resource Description

Climate Scenario :

specification of climate scenario (set of assumptions about future states related to climate)

Other Climate Scenario

Other Climate Scenario: GFDL R30 A2;

Exposure :

weather or climate related pathway by which climate change affects health

Air Pollution, Temperature

Air Pollution: Interaction with Temperature, Ozone, Particulate Matter, Other Air Pollution

Air Pollution (other): CO;NO2;SO2

Temperature: Fluctuations

Geographic Feature: ☑

resource focuses on specific type of geography

Urban

Geographic Location: ☑

resource focuses on specific location

Non-United States

Non-United States: Non-U.S. North America

Health Impact: ☑

specification of health effect or disease related to climate change exposure

Health Outcome Unspecified

Mitigation/Adaptation: ☑

mitigation or adaptation strategy is a focus of resource

Mitigation

Model/Methodology: ☑

type of model used or methodology development is a focus of resource

Exposure Change Prediction

Resource Type: ☑

format or standard characteristic of resource

Research Article

Timescale: ☑

time period studied

Long-Term (>50 years)